

# NXP ARM MICROCONTROLLER GUIDE



A comprehensive portfolio of industry leading performers,  
including the latest 32-bit LPC3000, LPC2000, LH7A and LH7 families.

NXP's microcontroller offering combines the highest performance in Flash with the lowest power consumption in the smallest packages. A comprehensive portfolio of industry leading performers, including the latest 32-bit LPC3000, LPC2000, LH7A and LH7 families. NXP offers an easy migration path from 8-bit to 32-bit solutions.

# NXP ARM Microcontroller Guide

## Table of Contents

NXP and Future Electronics Overview .....	4
ARM Microcontroller Applications Guide .....	5
Part and Family Selector Guide .....	6
<hr/>	
ARM9 Architecture Overview .....	8
LPC32x0 Devices .....	10
LPC3180 Device .....	12
LPC291x Devices .....	14
LH7A Devices .....	16
<hr/>	
ARM7 Architecture Overview .....	18
LPC28xx Devices .....	20
LH7 Devices .....	22
LPC24xx Devices .....	24
LPC23xx Devices .....	26
LPC22xx Devices .....	28
LPC215x, 214x and 213x Devices .....	30
LPC21xx Devices .....	32
LPC2104/05/06 Devices .....	34
LPC2101/02/03 Devices .....	36
<hr/>	
Additional Development Support .....	38



## NXP CORPORATE OVERVIEW

NXP is a top 10 semiconductor company founded by Philips in 2006. Headquartered in Europe, the company has 37,000 employees working in more than 20 countries and posted sales of USD 6.3 billion in 2007. NXP creates semiconductors, system solutions and software that deliver better sensory experiences in mobile phones, personal media players, TVs, set-top boxes, identification applications, cars and a wide range of other electronic devices.

NXP's portfolio builds on more than 50 years of experience in technology and is carefully crafted to take your designs to the next level. They are known for their selection, performance and flexibility, and have earned top rankings in key market sectors like mobile and portable, connected home, identification, automotive and multimarket semiconductors.

### **Selection, Performance and Flexibility**

NXP constantly look for fresh ways to save space, extend battery life, and make it easy to implement last-minute changes. All their products are optimized for performance, so they maximize integration while minimizing footprint and power consumption. They offer one of the largest selections in the industry so you always have a wide range of options to choose from.

Their microcontroller suite includes several families of highly integrated, cost-effective, 32-bit devices that meet a wide range of performance requirements. Features include ARM7- and ARM9-based architectures, high-performance Flash memory, special options for LCD control, very small footprints, low pin-count, low power consumption, comprehensive serial interfaces, and many 8-bit devices with enhanced 80C51 capabilities.

NXP currently holds the number-one position worldwide in 32-bit ARM-based microcontrollers.



## FUTURE ELECTRONICS OVERVIEW

Founded in 1968, Future Electronics is a worldwide leader in electronic components distribution, and is recognized as one of the most respected and innovative companies in the industry today. Headquartered in Montreal and operating in 41 countries around the world, Future Electronics has earned an impressive reputation for providing outstanding service and developing efficient, comprehensive global supply chain solutions.

The company's success is largely built upon its commitment to maintain close business partnerships with suppliers and customers, coupled with the strength of its commercial and technical competencies through all stages of the design-production cycle.

Future Electronics is globally integrated, supported by one worldwide IT infrastructure which provides real time inventory availability and access, while enabling full integration of operations, sales and marketing worldwide.

Future Electronics boasts the most knowledgeable sales team and provides the most advanced engineering/design capabilities and technical solutions, award-winning customer service, best-in-class global trade compliance program, and the largest available-to-sell inventory in the world.

Offering the industry's highest level of overall service, including customer-specific programs and processes, and worldwide e-commerce support, the company's mission is always to Delight the Customer®.

For more information or to access the Component Super Store, visit [www.FutureElectronics.com](http://www.FutureElectronics.com)

# ARM MICROCONTROLLER APPLICATIONS GUIDE

Whatever market you're in, whatever application you are building, few solutions are complete without the 'basic' elements. Covering all the essential ingredients, NXP's total solutions extend to the industry's widest portfolio of multimarket semiconductors including standard and specialty logic devices, discrete semiconductors, analog and mixed signal products, and a microcontroller offering recognized as one of the industry's most complete.

From the smallest 8-bit to the highest performing 32-bit ARM microcontrollers, they drive the industry as an innovation leader with their highly-integrated and cost-effective products. Their leading LPC3000 and LPC2000 ARM-based families have numerous, sophisticated integrated peripherals available. Their newest ARM-based LH7A and LH7 families feature high-resolution integrated LCD controllers and provide System-on-Chip capability.

Technology	Part or Series	CAN	Ethernet MAC	USB	LCD
ARM9	LPC32x0	–	yes	FS Device/Host/OTG	yes
ARM9	LPC3180/01	–	–	FS Device/Host/OTG	–
ARM9	LH7A404	–	–	FS Host/Device	yes
ARM9	LH7A400	–	–	FS Device	yes
ARM9	LPC29xx	2 ports	–	–	–
ARM7	LPC288x/01	–	–	HS Device	–
ARM7	LPC247x	2 ports	yes	FS Device/Host/OTG	yes
ARM7	LPC246x	2 ports	yes	FS Device/Host/OTG	–
ARM7	LPC23xx	2 ports (check series for specifics)	yes	FS Device/Host/OTG (check series for specifics)	–
ARM7	LPC229x/01	4 or 2 ports	–	–	–
ARM7	LPC2194/01	4 ports	–	–	–
ARM7	LPC2157/58	1 port (check series for specifics)	–	FS Device (on LPC2158)	yes
ARM7	LPC214x	–	–	FS Device	–
ARM7	LPC2129/01	2 ports	–	–	–
ARM7	LPC2119/01	2 ports	–	–	–
ARM7	LPC2109/01	1 port	–	–	–
ARM7	LH79524/25	–	yes	FS Device	yes
ARM7	LH79520	–	–	–	yes
ARM7	LH75411	–	–	–	yes
ARM7	LH75401	1 port	–	–	yes

# PART AND FAMILY SELECTOR GUIDE

## LPC3000 \* AND LH7A FAMILY – ARM9

Type	Memory				Timers		Serial interfaces				ADC (10-bit) No. of channels	I/O pins	External bus interface	PLL	Max. freq. (MHz)	CPU voltage	I/O voltage	Temp. range options	Package	Comments / Special features
	Flash (Kb)	RAM (Kb)	Instruction cache	Data cache	No. of timers	PWM channels	USB	UART	PC	SPI										
LPC32x0 series																				
LPC3220	–	128	32 K	32 K	7	11	1	7	2	2	3	87	•	•	208	1.2 V	3/2.8/1.8 V	F	TFBGA296	A/D converter (channel x bit) 3 x 10, 2 I²S, 2 SPI/SSP.
LPC3230	–	256	32 K	32 K	7	11	1	7	2	2	3	87	•	•	208	1.2 V	3/2.8/1.8 V	F	TFBGA296	A/D converter (channel x bit) 3 x 10, 2 I²S, 2 SPI/SSP, LCD Controller.
LPC3240	–	256	32 K	32 K	7	11	1	7	2	2	3	87	•	•	208	1.2 V	3/2.8/1.8 V	F	TFBGA296	A/D converter (channel x bit) 3 x 10, 2 I²S, 2 SPI/SSP, 10/100 Ethernet.
LPC3250	–	256	32 K	32 K	7	11	1	7	2	2	3	87	•	•	208	1.2 V	3/2.8/1.8 V	F	TFBGA296	A/D converter (channel x bit) 3 x 10, 2 I²S, 2 SPI/SSP, LCD Controller, 10/100 Ethernet.
LPC3100 series																				
LPC3180/01	–	64	32 K	32 K	4	2	1	7	2	2	3	55	•	•	208	1.2 V	3/1.8 V	F	LFBGA320	90-nm process, NAND Flash, SDRAM/DDR (1.8V), (1) USB 2.0 FS OTG, VFP unit, and SD card.
LPC2900 series																				
LPC2919	768	48	–	–	5	24	–	2	–	3	16	108	•	•	80	1.8 V	3.3 V	F	LDFP144	ARM968E-S MCU with 2 LIN Master Controllers, 16 KB I-TCM, 16 KB D-TCM.
LPC2917	512	48	–	–	5	24	–	2	–	3	16	108	•	•	80	1.8 V	3.3 V	F	LDFP144	ARM968E-S MCU with 2 LIN Master Controllers, 16 KB I-TCM, 16 KB D-TCM.
LH7A series																				
LH7A404	–	80 K Frame Buffer	8 K	8 K	5	2	1	3	0	1	10	64	•	•	266	1.8 V	3.3 V	F	LFBGA324	Integrated LCD controller: IrDA touchscreen interface. Touchscreen controller: MMU. USB 2.0 Full Speed Host/Device. 32-bit external data bus. CompactFlash. SDRAM controller: DMA controller: PCMCIA, BMI, PS/2, MMC/SD.
LH7A400	–	80 K Frame Buffer	8 K	8 K	5	0	1	3	0	1	–	60	•	•	245	1.8 V	3.3 V	F	BGA256 LFBGA256	Integrated LCD controller: IrDA. MMU. USB 2.0 Full Speed device. 32-bit external data bus. CompactFlash. SDRAM controller: MMC, PCMCIA, BMI.

\*Exception with 2900 ARM9 Series

## LPC2000 AND LH7 FAMILY – ARM7

Type	Memory		Timers		Serial interfaces								Analog			SD/MMC	I/O pins	External bus interface	PLL	Max. freq. (MHz)	CPU voltage	I/O voltage	Temp. range options	Package	Comments / Special features
	Flash	RAM	No. of timers *	PWM channels	Ethernet	USB	UART	I <sup>2</sup> C	CAN	SPI	SSP	I <sup>2</sup> S	ADC (10-bit) No. of channels	DAC (10-bit) No. of channels											
LPC2800 series																									
LPC2888	1 M	64 K	4	–	–	1	1	1	–	–	–	1	5	–	•	85	•	•	60	1.8V	3.3 V	F	TBGA180	USB V2.0 high speed; IrDA configurable; LCD interface logic; /D1 version for JTAG enabled (for development), /D1 version for JTAG disabled (for production).	
LPC2880	–	64 K	4	–	–	1	1	1	–	–	–	1	5	–	•	85	•	•	60	1.8V	3.3 V	F	TBGA180	LPC2880 is the ROM-less version of the LPC2888.	
LH7 series																									
LH79525	–	16 K + 8 K Cache	5	3	1	1	3	1	–	1	1	1	10	–	–	86	•	•	76	1.8V	3.3 V	F	LQFP176	ARM720T MCU with color LCD controller. Touchscreen interface. USB 2.0 device. IrDA. SDRAM controller: MMU. DMA. NAND Flash boot. 16-bit external data bus.	
LH79524	–	16 K + 8 K Cache	5	3	1	1	3	1	–	1	1	1	10	–	–	104	•	•	76	1.8V	3.3 V	F	LFBGA208	ARM720T MCU with color LCD controller. Touchscreen interface. USB 2.0 device. IrDA. SDRAM controller: MMU. DMA. NAND Flash boot. 32-bit external data bus.	
LH79520	–	32 K + 8 K Cache	6	2	–	–	3	–	–	1	1	–	–	–	–	64	•	•	77	1.8V	3.3 V	F	LQFP176	ARM720T MCU with color LCD controller. IrDA. SDRAM controller: MMU. 32-bit external data bus.	
LH75411	–	32 K	5	3	–	–	3	–	–	1	1	–	8	–	–	76	•	•	84	1.8V	3.3 V	F	LQFP144	Color LCD controller. Touchscreen interface. DMA controller: 5-V-tolerant I/O. 16-bit external data bus.	
LH75401	–	32 K	5	3	–	–	3	–	1	1	1	–	8	–	–	76	•	•	84	1.8V	3.3 V	F	LQFP144	Color LCD controller. Touchscreen interface. DMA controller: 5-V-tolerant I/O. 16-bit external data bus.	
LPC2400 series																									
LPC2478	512 K	98 K	6	12	1	1	4	3	2	1	2	1	8	1	•	160	•	•	72	3.3 V		F	LQFP208 TFBGA208	LPC2468 with XGA LCD controller.	
LPC2470	–	98 K	6	12	1	1	4	3	2	1	2	1	8	1	•	160	•	•	72	3.3 V		F	LQFP208 TFBGA208	LPC2460 with XGA LCD controller.	
LPC2468	512 K	98 K	6	12	1	1	4	3	2	1	2	1	8	1	•	160	•	•	72	3.3 V		F	LQFP208 TFBGA208	On-chip 4-MHz RC-Osc, GP DMA, RTC w/ 2 K batt. RAM 2 PWM blocks; USB 2.0 FS Host/OTG/device, DMA and 4 K RAM; UART 3 w/ IrDA; 32-bit ext. bus.	
LPC2460	–	98 K	6	12	1	1	4	3	2	1	2	1	8	1	•	160	•	•	72	3.3 V		F	LQFP208 TFBGA208	Flashless LPC2468.	
LPC2458	512 K	98 K	6	12	1	1	4	3	2	1	2	1	8	1	•	136	•	•	72	3.3 V		F	TBGA180	LPC2468 with 16-bit External Memory Interface.	

## LPC2000 AND LH7 FAMILY (CONTINUED) – ARM7

Type	Memory		Timers		Serial interfaces								Analog			SD/MMC	I/O pins	External bus interface	PLL	Max. freq. (MHz)	CPU voltage	I/O voltage	Temp. range options	Package	Comments / Special features
	Flash	RAM	No. of timers*	PWM channels	Ethernet	USB	UART	I <sup>2</sup> C	CAN	SPI	SSP	I <sup>2</sup> S	ADC (10-bit) No. of channels	DAC (10-bit) No. of channels											
LPC2300 series																									
LPC2388	512 K	98 K	6	6	1	1	4	3	2	1	2	1	8	1	•	104	•	•	72	3.3 V	F	LQFP144	LPC2378 with 98 K SRAM and USB Host/OTG.		
LPC2387	512 K	98 K	6	6	1	1	4	3	2	1	2	1	6	1	•	70	•	•	72	3.3 V	F	LQFP100	LPC2368 with 98 K SRAM.		
LPC2378	512 K	58 K	6	6	1	1	4	3	2	1	2	1	8	1	•	104	•	•	72	3.3 V	F	LQFP144	On-chip 4MHz RC-Osc, GP DMA, RTC w/ 2 K batt. RAM USB 2.0 FS device w/ PHY, DMA and 4 K RAM; UART 3 w/ IrDA; MiniBus (8-bit).		
LPC2377	512 K	58 K	6	6	1	–	4	3	–	1	2	1	8	1	•	104	•	•	72	3.3 V	F	LQFP144	LPC2378 without USB or CAN.		
LPC2368	512 K	58 K	6	6	1	1	4	3	2	1	2	1	6	1	•	70	–	•	72	3.3 V	F	LQFP100	100-pin version of LPC2378, no external bus.		
LPC2367	512 K	58 K	6	6	1	–	4	3	–	1	2	1	6	1	•	70	–	•	72	3.3 V	F	LQFP100	LPC2368 without USB or CAN.		
LPC2366	256 K	58 K	6	6	1	1	4	3	2	1	2	1	6	1	–	70	–	•	72	3.3 V	F	LQFP100	256 K Flash version of LPC2368, no SD/MMC.		
LPC2365	256 K	58 K	6	6	1	–	4	3	–	1	2	1	6	1	–	70	–	•	72	3.3 V	F	LQFP100	LPC2366 without USB or CAN.		
LPC2364	128 K	34 K	6	6	1	1	4	3	2	1	2	1	6	1	–	70	–	•	72	3.3 V	F	LQFP100	128 K Flash / 34 K RAM version of LPC2368, no SD/MMC.		
LPC2200 series																									
LPC2294/01	256 K	16 K	5	6	–	–	2	1	4	2	–	–	8	–	–	112	•	•	60	1.8 V	3.3 V	H	LQFP144	LPC2214/01 upgrade with 4x CAN.	
LPC2292/01	256 K	16 K	5	6	–	–	2	1	2	2	–	–	8	–	–	112	•	•	60	1.8 V	3.3 V	F	LQFP144 TFBGA144	LPC2214/01 upgrade with 2x CAN.	
LPC2290/01	–	64 K	5	6	–	–	2	1	2	2	–	–	8	–	–	76	•	•	60	1.8 V	3.3 V	F	LQFP144	ROM-less version of LPC2292/01.	
LPC2220	–	64 K	5	6	–	–	2	1	–	2	–	–	8	–	–	76	•	•	75	1.8 V	3.3 V	F	LQFP144 TFBGA144	64 K RAM version of LPC2210/01.	
LPC2214/01	256 K	16 K	5	6	–	–	2	1	–	2	–	–	8	–	–	112	•	•	60	1.8 V	3.3 V	F	LQFP144	External Bus, 4 Chip Selects, 10-bit SA ADC, 256 K Flash.	
LPC2212/01	128 K	16 K	5	6	–	–	2	1	–	2	–	–	8	–	–	112	•	•	60	1.8 V	3.3 V	F	LQFP144	128 K Flash version of LPC2214/01.	
LPC2210/01	–	16 K	5	6	–	–	2	1	–	2	–	–	8	–	–	76	•	•	60	1.8 V	3.3 V	F	LQFP144	ROMless version of LPC2214/01.	
LPC2100 series																									
LPC2194/01	256 K	16 K	5	6	–	–	2	1	4	2	–	–	4	–	–	46	–	•	60	1.8 V	3.3 V	H	LQFP64	LPC2124/01 upgrade with 4x CAN.	
LPC2158	512 K	40 K	5	6	–	1	2	1	–	1	1	–	8+6	1	–	32	–	•	60	3.3 V	F	LQFP100	LPC2148 with 32 x 4 LCD driver.		
LPC2157	512 K	32 K	5	6	–	–	2	2	–	1	1	–	2x8	1	–	32	–	•	60	3.3 V	F	LQFP100	LPC2138/01 with 32 x 4 LCD driver.		
LPC2148	512 K	40 K	5	6	–	1	2	2	–	1	1	–	8+6	1	–	45	–	•	60	3.3 V	F	LQFP64	LPC2138 plus USB 2.0 full speed.		
LPC2146	256 K	40 K	5	6	–	1	2	2	–	1	1	–	8+6	1	–	45	–	•	60	3.3 V	F	LQFP64	LPC2136 plus USB 2.0 full speed.		
LPC2144	128 K	16 K	5	6	–	1	2	2	–	1	1	–	8+6	1	–	45	–	•	60	3.3 V	F	LQFP64	LPC2134 plus USB 2.0 full speed.		
LPC2142	64 K	16 K	5	6	–	1	2	2	–	1	1	–	6	1	–	45	–	•	60	3.3 V	F	LQFP64	LPC2132 plus USB 2.0 full speed.		
LPC2141	32 K	8 K	5	6	–	1	2	2	–	1	1	–	6	–	–	45	–	•	60	3.3 V	F	LQFP64	LPC2131 plus USB 2.0 full speed.		
LPC2138/01	512 K	32 K	5	6	–	–	2	2	–	1	1	–	2x8	1	–	47	–	•	60	3.3 V	F	LQFP64 HVQFN64	Dual 8-ch. 10-bit ADC, BOD, POR, 32-kHz XTAL input, VBAT, Fast I/O.		
LPC2136/01	256 K	32 K	5	6	–	–	2	2	–	1	1	–	2x8	1	–	47	–	•	60	3.3 V	F	LQFP64	256 K Flash version of LPC2138/01.		
LPC2134/01	128 K	16 K	5	6	–	–	2	2	–	1	1	–	2x8	1	–	47	–	•	60	3.3 V	F	LQFP64	128 K Flash, 16 K RAM version of LPC2138/01.		
LPC2132/01	64 K	16 K	5	6	–	–	2	2	–	1	1	–	8	1	–	47	–	•	60	3.3 V	F	LQFP64 HVQFN64	64 K Flash, 16 K RAM version of LPC2138/01.		
LPC2131/01	32 K	8 K	5	6	–	–	2	2	–	1	1	–	8	–	–	47	–	•	60	3.3 V	F	LQFP64	32 K Flash, 8 K RAM version of LPC2138/01.		
LPC2129/01	256 K	16 K	5	6	–	–	2	1	2	2	–	–	4	–	–	46	–	•	60	1.8 V	3.3 V	F	LQFP64	LPC2124/01 upgrade with 2x CAN.	
LPC2119/01	128 K	16 K	5	6	–	–	2	1	2	2	–	–	4	–	–	46	–	•	60	1.8 V	3.3 V	F	LQFP64	LPC2114/01 upgrade with 2x CAN.	
LPC2109/01	64 K	8 K	5	6	–	–	2	1	1	2	–	–	4	–	–	46	–	•	60	1.8 V	3.3 V	F	LQFP64	LPC2119/01 with 64 KB Flash, 8 KB RAM, and 1x CAN.	
LPC2124/01	256 K	16 K	5	6	–	–	2	1	–	2	–	–	4	–	–	46	–	•	60	1.8 V	3.3 V	F	LQFP64	10-bit SA ADC, 2x SPI and 256 K Flash.	
LPC2114/01	128 K	16 K	5	6	–	–	2	1	–	2	–	–	4	–	–	46	–	•	60	1.8 V	3.3 V	F	LQFP64	128 K Flash version of the LPC2124/01.	
LPC2106/01	128 K	64 K	5	6	–	–	2	1	–	1	–	–	–	–	–	32	–	•	60	1.8 V	3.3 V	B,F	LQFP48	64 K RAM, 128 K Flash.	
LPC2105/01	128 K	32 K	5	6	–	–	2	1	–	1	–	–	–	–	–	32	–	•	60	1.8 V	3.3 V	B	LQFP48	32 K RAM version of LPC2106/01.	
LPC2104/01	128 K	16 K	5	6	–	–	2	1	–	1	–	–	–	–	–	32	–	•	60	1.8 V	3.3 V	B	LQFP48	16 K RAM version of LPC2106/01.	
LPC2103	32 K	8 K	6	14 <sup>9+5</sup>	–	–	2	2	–	1	–	–	8	–	–	32	–	•	70	1.8 V	3.3 V	F	LQFP48	Lowest cost, lowest power; ADC.	
LPC2102	16 K	4 K	6	14 <sup>9+5</sup>	–	–	2	2	–	1	–	–	8	–	–	32	–	•	70	1.8 V	3.3 V	F	LQFP48 HVQFN48	16 K Flash, 4 K RAM version of LPC2103.	
LPC2101	8 K	2 K	6	14 <sup>9+5</sup>	–	–	2	2	–	1	–	–	8	–	–	32	–	•	70	1.8 V	3.3 V	F	LQFP48	8 K Flash, 2 K RAM version of LPC2103.	

Note: Reset active low. \* Includes Watchdog timer and real-time clock. \*\* Using timers 0-3.

# NXP ARM9 Architecture Overview

NXP's LPC3000 and LH7A ARM9 portfolios are based on the ARM926EJ (ARM9E) and ARM922T (ARM9) processor families.

The ARM9E processor family enables single processor solutions for microcontroller, DSP and Java applications, offering savings in chip area and complexity, power consumption, and time-to-market. The ARM9E family of products are DSP-enhanced 32-bit RISC processors, well suited for applications requiring a mix of DSP and microcontroller performance. They include signal processing extensions to enhance 16-bit fixed point performance using a single-cycle 32 x 16 multiply-accumulate (MAC) unit, and implement the 16-bit Thumb® instruction set giving excellent code density, maximizing savings on system cost. The ARM926EJ-S processor also includes ARM Jazelle™ technology which enables the direct execution of Java bytecodes in hardware.

The ARM9 processor family is built around the ARM9TDMI processor and incorporates the 16-bit Thumb instruction set, which improves code density by as much as 35%. The ARM9 family's comprehensive feature set enables developers to implement leading-edge systems, while delivering considerable savings in chip area, time-to-market, development costs and power consumption.



## ARM9/ARM9E CORE FEATURES

- ▶ 32-bit RISC processor with ARM®, Thumb® and DSP instruction sets
- ▶ ARM Jazelle technology delivers 8x Java acceleration (ARM926EJ-S)
- ▶ 5-stage integer pipeline achieves 1.1 MIPS/MHz
- ▶ Single 32-bit AMBA bus interface
- ▶ Integrated real-time trace and debug support
- ▶ 215 MFLOPS for 3D graphics and real-time control systems
- ▶ High-performance AHB system
- ▶ MMU supporting Windows CE, Symbian OS, Linux, Palm OS (ARM926EJ-S)
- ▶ Integrated instruction and data caches
- ▶ Real-time debug support for SoC designers, including ETM interface
- ▶ Up to 16-entry write buffer — avoids stalling the processor when writes to external memory are performed

The NXP LPC3000 family is the only ARM9 microcontroller that provides a vector floating-point co-processor and integrated USB On-The-Go, as well as the ability to operate in ultra-low-power mode down to 0.9V. With speeds of up to 208 MHz, the NXP LPC3180 series supports Linux and WinCE and is ideal for a wide range of high-precision applications such as point-of-sale (POS) equipment, medical devices, and global positioning systems (GPS).

To save time-to-market for applications that use an LCD screen, NXP's LH7A, ARM922T-based microcontrollers are equipped with an LCD controller. Supported by a comprehensive set of software and hardware design tools, the LH7A series makes it easy to create everything from cost-conscious consumer systems to advanced systems with media-rich environments.

# LPC32x0 Devices

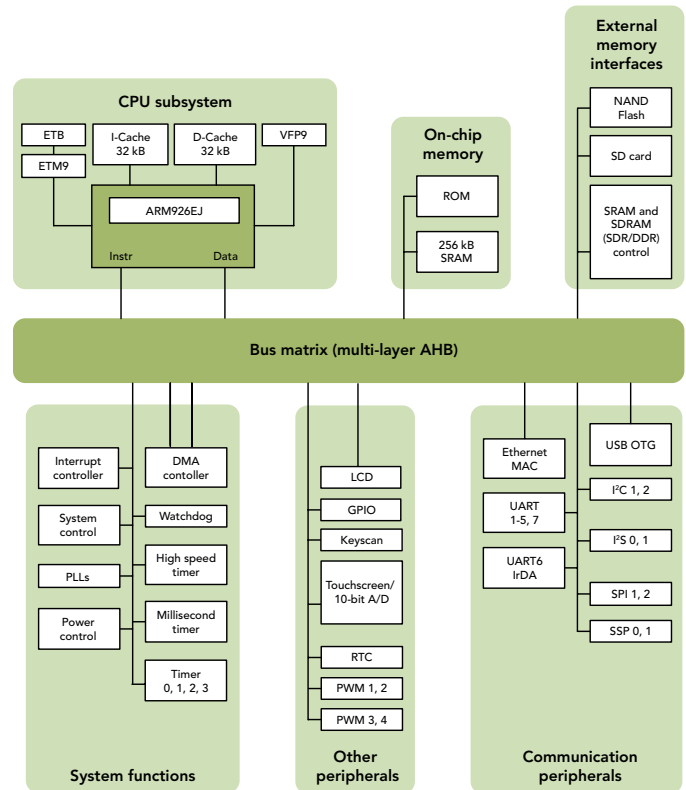
These advanced microcontrollers use a powerful ARM926EJ-S core, a VFP co-processor, an internal bus matrix, and a large set of standard peripherals to achieve outstanding performance.

## KEY FEATURES

- ▶ 208-MHz, 32-bit ARM926EJ-S with Embedded Trace Module (ETM)
- ▶ Vector Floating-Point co-processor
- ▶ 90-nm technology for operation down to 0.9 V in low-power mode
- ▶ Up to 256 KB of internal SRAM and 32 KB I-cache/32 KB D-cache
- ▶ External memory controller for DDR and SDR SDRAM, SRAM, and Flash
- ▶ Selectable boot-up from NAND Flash, SPI memory, UART, or static memory
- ▶ 10/100 Ethernet MAC with dedicated DMA controller (LPC3240 & LPC3250 only)
- ▶ USB OTG with full-speed host and device capabilities
- ▶ 24-bit LCD controller with dedicated DMA controller supports STN and TFT panels (LPC3230 & LPC3250 only)
- ▶ Three-channel, 10-bit A/D converter with touchscreen interface
- ▶ Comprehensive set of serial interfaces (two I<sup>2</sup>S, two SPI, two SSP, two I<sup>2</sup>C-bus, and seven UARTs)
- ▶ SD memory-card interface
- ▶ Six 32-bit timers, Watchdog timer, 11 PWM channels, and real-time clock with separate clock and power domain
- ▶ 8-channel, general-purpose DMA controller
- ▶ Keyboard-scan interface for 8 x 8 keys and up to 87 GPIO
- ▶ JTAG interface with emulation trace buffer
- ▶ Core voltage = 1.2 V, I/O = 1.8, 2.8, and 3.0 V
- ▶ TFBGA296 package (15 x 15 x 0.8 mm)



NXP 208-MHz, 32-bit ARM926EJ-S processor LPC32x0



LPC32x0 block diagram

## DEVELOPMENT TOOLS

### PHYCORE®-ARM9/LPC3250 LOW POWER ARM9 WITH VFP

The phyCORE-LPC3250 is an ARM-9 based, small form factor, OEM-able module populated with the NXP LPC3250. State-of-the-art power management, Floating-Point Unit, and rich peripherals such as USB OTG, Ethernet, and integrated LCD controller make this module the ideal candidate for embedded applications requiring high performance and low power consumption. The on-board MMU supports major operating systems, including Linux and Windows Embedded CE. Other chip-level features include 7 UARTs, SPI, I<sup>2</sup>C, a real-time clock with a separate power domain, and NAND Flash and DDR memory controllers. These features make the devices particularly suitable for automotive and industrial control applications as well as medical systems.

- ▶ NXP LPC3250 ARM926EJ-S processor with integrated Memory Management Unit (MMU)
- ▶ 208 MHz core frequency
- ▶ Vector Floating-Point (VFP) co-processor
- ▶ TFT/STN LCD Controller
- ▶ 10/100 MBit Ethernet supporting HP Auto-MDIX
- ▶ USB OTG Full-Speed
- ▶ 2 x SPI / 2 x SSP
- ▶ 2 x I<sup>2</sup>C / 2 x I<sup>2</sup>S
- ▶ 4 x Standard UARTs (1 @ RS-232)
- ▶ 3 x High-Speed UARTs (1 @ RS-232)
- ▶ Single supply 3.15V
- ▶ Memory Configuration:
  - SDRAM: 64 MB (Optional 16, 32, 128 MB)
  - NOR Flash: 2 MB (Optional 1,4,8 MB)
  - NAND Flash: 32 MB (Optional 16, 64, 128 MB)
  - SPI EEPROM: 256 KB (Optional 128 or 256 KB)
- ▶ SD/MMC support (1 slot on Carrier Board)
- ▶ SDIO controller supporting SD, SDIO, and CE-ATA devices
- ▶ Real-Time Clock - I<sup>2</sup>C (on-board)
- ▶ Real-Time Clock (on-chip)
- ▶ JTAG interface
- ▶ Module connector: 0.635 mm pitch, 2x 160-pin Molex
- ▶ Dimensions: 58 x 70 mm
- ▶ Temperature range: -40°C to + 85°C

The phyCORE SBC module is designed to plug into a PHYTEC Carrier Board that provides the I/O connectors as well as any other interface circuitry not provided on the phyCORE module itself. The phyCORE module, combined with the PHYTEC Carrier Board, provides a platform to jump-start embedded designs and propel concept to prototype and finished product. The phyCORE-LPC3250 Rapid Development Kit includes the module and carrier board, 3.5" color LCD with integrated touch, Windows Embedded CE 6.0 OS demo image, and all the contents required to enable users to successfully set up target hardware and build and load a Windows Embedded CE binary image with Platform Builder.



## LPC32x0 SELECTION GUIDE

Type	SRAM (KB)	A/D converter (channel x bit)	10/100 Ethernet	LCD controller	USB host, device, OTG	Serial interfaces				Temperature range (°C)	Package
						I <sup>2</sup> C-bus	SPI/SSP	I <sup>2</sup> S	UART		
LPC3220	128	3 x 10	0	0	1	2	2	2	7	-40 to +85	TFBGA296
LPC3230	256	3 x 10	0	1	1	2	2	2	7	-40 to +85	TFBGA296
LPC3240	256	3 x 10	1	0	1	2	2	2	7	-40 to +85	TFBGA296
LPC3250	256	3 x 10	1	1	1	2	2	2	7	-40 to +85	TFBGA296

# LPC3180/01 Device

A USB OTG interface with full host capability lets this high-performance microcontroller connect directly to peripherals. Other options – including seven UARTs, two SPI, two I<sup>2</sup>C, a real-time clock with separate power domain, and controllers for NAND Flash and SDRAM memory – increase design flexibility.

## KEY FEATURES

- ▶ 208-MHz, 32-bit ARM9EJ-S with AHB/APB interfaces
- ▶ 90-nm technology for operation down to 0.9 V in low-power mode
- ▶ Vector floating-point co-processor
- ▶ External memory interface for Flash, SDR, and DDR SDRAM
- ▶ 64 KB of SRAM, 32 K of instruction and data cache
- ▶ USB OTG with full-speed host capability
- ▶ General-purpose DMA controller and memory management unit
- ▶ 10-bit A/D converter
- ▶ Multiple serial interfaces: two I<sup>2</sup>C, two SPI, seven UART
- ▶ Two 32-bit timers and real-time clock with separate clock and power domain
- ▶ JTAG interface with emulation-trace buffer
- ▶ 1.2-V core voltage, 3-V and 1.8-V I/O
- ▶ Secure Digital (SD) memory-card interface
- ▶ Package: LFBGA320 (13 x 13 x 0.9 mm)



Low-power, ARM9-based microcontroller

External Memory I/F (NAND, SD, and DRAM)	E-ICE/RTM Interface Embedded Trace Buffer
64-KB SRAM	Interrupt Controller
DMA	MMU
Vector Floating-Point Co-processor 32-bit ARM926EJ-S Bus Matrix	
32-K D Cache	32-K I Cache
Power Management, Real-time Clock, Watchdog Timer, PLL	
10-bit A/D Converter (Three Channels)	USB 2.0 Full-speed / Host / OTG
Two timers with Capture / Compare	2 x PWM (1 Channel Each)
2 x I <sup>2</sup> C (Master Only)	2 x SPI (Master Only)
UART 1-7 (UART6 supports IrDA)	Keyscan
I/O ports (55)	

LPC3180/01 block diagram

## DEVELOPMENT TOOLS

### PHYCORE®-ARM9/LPC3180 ARM9 WITH VECTOR FLOATING-POINT UNIT

The phyCORE-ARM9/LPC3180 supports the industry's first 90nm ARM9-based microcontroller. The 32-bit MCU high-performance, low power LPC3180 ARM926EJ-S device from NXP Semiconductors (founded by Philips) provides a vector floating-point co-processor and integrated USB OTG, as well as the ability to operate in ultra-low-power mode down to 0.9V. The on-board MMU supports major operating systems, including Linux which is the leading major embedded OS. Other chip-level features include 7 UARTs, SPI, I<sup>2</sup>C, a real-time clock with a separate power domain, and NAND Flash and DDR memory controllers. These features make the devices particularly suitable for automotive and industrial control applications as well as medical systems.

- ▶ Single Board Computer in subminiature dimensions (60 x 53 mm) according to low EMI phyCORE specifications
- ▶ NXP Semiconductors (founded by Philips) LPC3180 ARM926EJ-S controller (208 MHz) with VFP9 hardware vector floating-point co-processor for speed and efficiency as well as 2x SPI, 2x I<sup>2</sup>C, 2x PWM, MMU and 3-channel/10-bit ADC
- ▶ Controller and board-level signals extend to two high-density (0.635 mm) 100-pin Molex connectors on underside of SBC
- ▶ Memory configuration:
  - SDRAM: 16 to 64 MB synchronous SDRAM, max. access time of 10ns, 32-bit organization
  - Flash: 16 to 128 MB NAND-Flash in 8-bit mode
  - Serial: 1 to 32 KB I<sup>2</sup>C-EEPROM
- ▶ On-chip Real-Time Clock with Alarm function and battery back-up
- ▶ On-chip USB Host/Device interface (can be used as USB-OTG in conjunction with external ISP1301 USB-OTG device)
- ▶ USB-Ethernet adapter support (Suggested: SMC2209USB/ETH)
- ▶ 7x UARTs, 3x of which at RS-232 level (2x standard, 1x High-Speed with Handshake)
- ▶ JTAG signals extend to edge connector
- ▶ Industrial temperature range (-40 to +85°C)



### NOHAU LPC3000 EVALUATION BOARD

Nohau's LPC3000 Evaluation Board is an effective tool to develop embedded systems using the LPC3000 family of microcontrollers. Development for the LPC3180 is supported by the Nohau JTAG debugger, C compilers, and Real-Time Operating Systems. Linux and µC/OS-2 RTOS have been ported to the evaluation board. The evaluation board comes with a detailed user guide to help the user get a jump-start in LPC3180 development. There is also an available option to upgrade the JTAG interface to add full-fledged trace debug functionality.

- ▶ NXP LPC3180 microcontroller
- ▶ Single power supply input (5.0V)—regulated on board to provide all the necessary EVB voltages
- ▶ User reset pushbutton switch
- ▶ 20-way JTAG/ETB connector
- ▶ 32M (8M x 32) Bytes of SDRAM
- ▶ 32M (32M x 8) Bytes of NAND FLASH
- ▶ (1) LCD module with NXP PCF8558 built in
- ▶ (1) SD card connector
- ▶ (3) USB connectors (USB A receptacle connector for USB host; USB B receptacle connector for USB device; USB mini AB receptacle connector for USB OTG) with NXP ISP1301
- ▶ (3) UART (RS232) physical interface circuits connected to standard PC style DB9 female connectors
- ▶ (4) 80-pin break-out headers to provide easy access to many of the microcontroller pins
- ▶ (4) User-input pushbutton switches
- ▶ (2) User-output LEDs
- ▶ Small prototyping area consisting of an area of 0.1 inch spaced through-holes with easy access to ground and 3.0V and 1.8V power supply points



## LPC3180/01 SELECTION GUIDE

Type	External memory interface	SRAM	I-cache	D-cache	USB 2.0 + OTG	I <sup>2</sup> C	SPI	UARTs	ADC channels (10-bit)	Package
LPC3180/01	1	64 KB	32 K	32 K	1	2	2	7 <sup>(1)</sup>	3	LFPGA320

(1) UART6 supports IrDA

# LPC291x Devices

Built around an ARM968 core, this 32-bit microcontroller is optimized for automotive and industrial applications and fills the performance gap between ARM7TDMI and ARM926EJ technologies. It offers high-performance and very low power consumption, integrates CAN 2.0B and LIN 2.0 controllers, and is available in an LQFP144 package.

## KEY FEATURES

- ▶ 80-MHz, 32-bit ARM968E-S with AHB/APB interfaces
- ▶ Two TCM memories: 16-KB instruction, 16-KB data
- ▶ 48 KB of SRAM
- ▶ Up to 768 KB Flash program memory
- ▶ Two CAN 2.0B controllers
- ▶ Two dedicated LIN 2.0 master controllers
- ▶ Two 3V 10-bit ADC with 8 channels each
- ▶ Two 16C550 UARTs with 16-byte Tx and Rx FIFO depths
- ▶ Three full-duplex Q-SPI interfaces with four slave-select lines
- ▶ Four 32-bit timers, four 6-channel 32-bit PWM units, Watchdog timer
- ▶ 32-bit external memory controllers
- ▶ 108 GPIO (tolerant to 5 V)
- ▶ Temperature range: -40 to +85 °C
- ▶ LQFP144 package



NXP 80-MHz, 32-bit  
ARM968 microcontroller  
LPC291x with CAN and LIN

16 KB of Instruction Tightly Coupled Memory	16 KB of Data Tightly Coupled Memory
48 KB of total SRAM	Up to 768 KB of 128-bit-wide Flash
JTAG debug interface	
80-MHz, 32-bit ARM968E-S core with AHB and APB interfaces	
Power management, Watchdog timer, PLL	
32-bit external memory controller	Vectored interrupt controller
Two 16C550 UARTs	3 x SPI
Four 32-bit timers with capture/compare channels	Four 6-channel 32-bit PWM units
Two 3V 8-channel, 10-bit ADCs	
Two CAN 2.0B controllers with global acceptance	Two LIN 2.0 master controllers
108 GPIO (tolerant to 5V)	

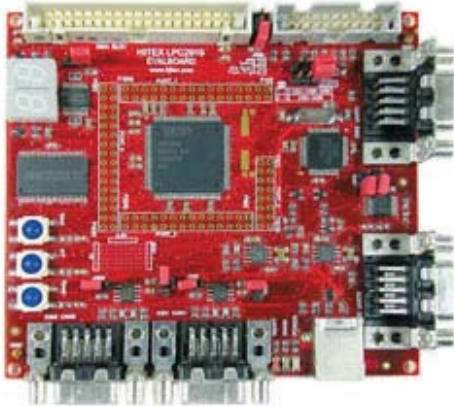
LPC291x block diagram

## DEVELOPMENT TOOLS

### HITEX LPC2919 EVALUATION BOARD

This evaluation board hosts the LPC2919 microcontroller from NXP with an embedded ARM968E-S processor core and with a JTAG interface. In addition the driver chips for the external communication interfaces are included together with a wire-wrap area. All microcontroller IO port pins are accessible via connectors. The device drivers can be disabled via jumpers to have control of the microcontroller IO pins. The board is USB powered and enumerates as a mass storage memory device.

- ▶ Evaluation board for NXP LPC2919 microcontroller in LQFP144 package
- ▶ Support for internal 768kByte FLASH and 80kByte SRAM
- ▶ Support of 2 CAN ports
- ▶ Support of 2 RS232 ports
- ▶ External SRAM 512k x 8 (limitation for evaluation board V1.0)
- ▶ 2 x small 7-segment LEDs attached to port pins
- ▶ 3 buttons for reset, IRQ and port pin
- ▶ 32,768kHz + 16MHz Quartz
- ▶ Configuration of ports, reset, etc. via jumpers
- ▶ JTAG debugger support with JTAG connector
- ▶ 2 x 24-pin connector for BLDC motor add-on board
- ▶ 1.8V and 3.3V power regulator, +5V directly from USB
- ▶ Free wire-wrap area 20x20 pads
- ▶ USB powered or alternative external power via BLDC connector
- ▶ Power, reset and enumeration LED indicator
- ▶ PCB, size 100 x 110mm

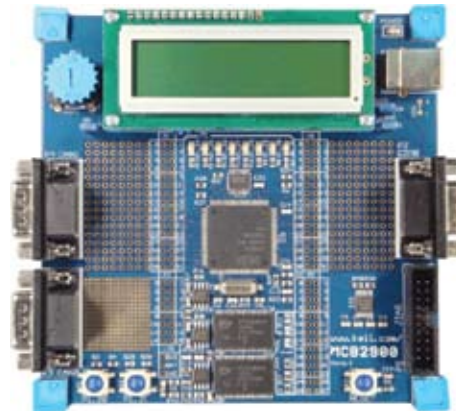


### KEIL MCB2900 EVALUATION BOARD

The Keil MCB2900 Evaluation Board connects to your PC using the JTAG interface (for program debug using the Keil ULINK2 USB-JTAG Adapter and the µVision IDE and Debugger). Two Serial and two CAN interfaces make this board a great starting point for your next ARM project.

The connectors on the MCB2900 evaluation board provide easy access to many of the on-chip peripherals.

- ▶ **Serial Port**  
A standard DB9 connector is available on the MCB2900 for the LPC2900's serial port. Your application may use this port, if required.
- ▶ **Dual CAN Ports**  
Standard DB9 connectors are on the MCB2900 board for applications requiring CAN communications. Your application may use either or both of these ports, or they may be disabled with a configuration jumper.
- ▶ **Analog Voltage Control for ADC Input**  
An adjustable analog voltage source is on the MCB2900 board for testing the Analog to Digital output feature of the LPC2900. A configuration jumper enables and disables this feature.
- ▶ **JTAG Download and Debug**  
A JTAG interface is on the MCB2900 board and, coupled with the ULINK USB-JTAG adapter, allows flash programming. The on-chip debug interface can perform real-time in-circuit emulation of the LPC2900 device.
- ▶ **External RAM**  
1MB with 16-bit BUS configuration, alternatively 512KB with 8-bit BUS configuration.



### LPC291x SELECTION GUIDE

Type	Memory				Serial interfaces				ADCs	External memory	Package
	Flash (MB)	SRAM (KB)	ITCM (KB)	DTCM (KB)	CAN 2.0B	LIN 2.0	16C UART	SPI			
LPC2917	512	48	16	16	2	2	2	3	2	•	LQFP144
LPC2919	768	48	16	16	2	2	2	3	2	•	LQFP144

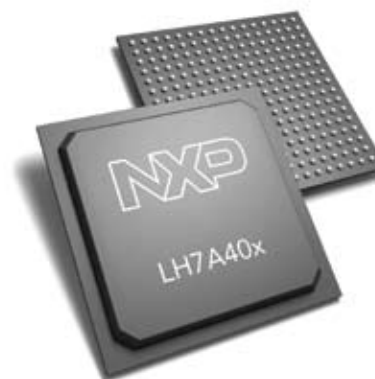


# LH7A Devices

These flexible, powerful microcontrollers, based on ARM9 cores, integrate an LCD controller, so they save time-to-market for applications that use an LCD screen. Supported by comprehensive software and hardware design tools, they make it easy to create everything from cost-conscious consumer systems to advanced systems with media-rich environments.

## KEY FEATURES

- ▶ Up to 266-MHz, 32-bit ARM922T™ core
- ▶ Integrated LCD controller
  - Support for STN, CSTN, TFT, and AD-TFT
  - Resolutions up to 1024 x 768
  - 16-level greyscale or up to 64k colors
- ▶ 32-bit external bus with SDRAM controller and NAND Flash boot capability
- ▶ 80-KB frame buffer, and 8 KB each of instruction and data cache
- ▶ 10-channel, 10-bit A/D converter with touchscreen interface (LH7A404 only)
- ▶ USB 2.0 host and device
- ▶ Multiple 16-bit counter/timers and multiple PWMs
- ▶ Real-time clock, Watchdog timer, and PLL
- ▶ Extensive selection of serial interfaces, including SSI/SSP, three UARTs, IrDA, I<sup>2</sup>C-bus, I<sup>2</sup>S
- ▶ General-purpose DMA controller
- ▶ CompactFlash, SD/MMC/SDIO, PS/2, audio codec (AC97), and PCMCIA interfaces
- ▶ Up to 64 GPIO
- ▶ Temperature range: -40 to +85 °C
- ▶ BGA and LFBGA packages



NXP 266-MHz ARM9 microcontroller with integrated LCD controller LH7A40x

32-bit external data bus	NAND Flash boot capability (LH7A404)
80-KB frame buffer 8-KB instruction cache 8-KB data cache	SDRAM controller
Up to 266-MHz, 32-bit ARM922T core	
Watchdog timer, real-time clock, PLL	
Color / greyscale LCD controller	
Integrated touchscreen controller (LH7A404)	10-channel, 10-bit A/D converter (LH7A404)
I <sup>2</sup> C-bus or SMBus	USB 2.0 full-speed device (LH7A400) or USB 2.0 full-speed host/device (LH7A404)
SSI/SSP	Three UARTs with IrDA support
Multiple 16-bit counter/timers	Multiple PWMs (LH7A404 only)
MMC/SD/SDIO interface	CompactFlash, audio codec, PCMCIA and PS/2 interfaces
Up to 64 GPIO	

LH7A4xx block diagram



## DEVELOPMENT TOOLS

### AUCKLAND EVA EVALUATION BOARD ARM9 MODULE, BASED ON NXP LH7A404

The AUCKLAND module is a credit-card-sized 32-bit processor module based on the ARM9. It has a very powerful processor core and a wide range of interfaces for expansion and periphery module purposes. The low energy consumption and excellent graphics capability make it ideal for mobile use and for devices with graphical user interfaces.

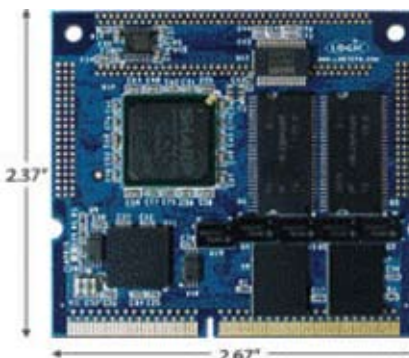
- ▶ High Performance 200 MHz ARM9 RISC controller
- ▶ Integrated graphics controller up to 1024 x 768 pixels
- ▶ Low power consumption (typical 1 Watt)
- ▶ Extended temperature range
- ▶ Low cost evaluation kit available
- ▶ Suspend to RAM mode (< 2mA)
- ▶ System on a module with complete Windows CE 5.0 support
- ▶ FlashnGo BIOS with remote control interface for setup and maintenance



### LOGIC PD LH7A404 CARD ENGINE

- ▶ NXP ARM922T LH7A404 32-bit microprocessor running up to 200 MHz
- ▶ SDRAM memory 64 MB
- ▶ Flash memory 16 or 32 MB NOR
- ▶ Built-in LCD controller supports up to 1024 x 768 x 8 bits per pixel
- ▶ Integrated 4-wire touchscreen controller
- ▶ 10/100 Base-T Ethernet controller (application/debug)
- ▶ AC97 compliant audio codec
- ▶ PC card expansion CompactFlash Type I card (memory-mapped mode only)
- ▶ Smart Card, MMC/SD, dual PCMCIA interfaces
- ▶ Two USB 2.0 full-speed host interfaces
- ▶ USB 2.0 full-speed device interface
- ▶ Three 16C550 compatible UARTs
- ▶ SPI interface
- ▶ LogicLoader™ (boot loader/monitor)
- ▶ Card Engine form factor (60.2 x 67.8 x 4.4 mm)
- ▶ RoHS compliant

\*see page 23 for LogicPD ZOOM™ SDK



## LH7A40x SELECTION GUIDE

Type	CPU core	RAM	GPIO	LCD controller	A/D converter	Serial interfaces	Temperature range (°C)	Package
LH7A400	ARM922T	8 KB (I-cache) 8 KB (D-cache) 80 KB (frame buffer)	60	1024 x 768: 64k colors STN, CSTN, TFT, AD-TFT	—	SPI/SSP, 3 x UART, IrDA, USB 2.0 device	-40 to +85	BGA256 LFBGA256
LH7A404	ARM922T	8 KB (I-cache) 8 KB (D-cache) 80 KB (frame buffer)	64	1024 x 768: 64k colors STN, CSTN, TFT, AD-TFT	10 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART, IrDA, USB 2.0 device and host	-40 to +85	LFBGA324

# NXP ARM7 Architecture Overview

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The ARM7 family is a range of low power 32-bit RISC microprocessor cores optimized for cost and power sensitive consumer applications.

Offering up to 130MIPs (Dhrystone2.1), the ARM7 family incorporates the Thumb 16-bit instruction set - enabling 32-bit performance at 8/16-bit system cost. The family consists of the ARM7TDMI, ARM7TDMI-S and ARM7EJ-S processor cores and the ARM720T cached processor macrocell, each of which has been developed to address different market requirements.

## ARM7 CORE FEATURES

- ▶ Established, high-volume 32-bit RISC architecture
- ▶ Up to 130 MIPS (Dhrystone 2.1) performance on a typical 0.14µm process
- ▶ Small die size and very low power consumption
- ▶ High code density, comparable to 16-bit microcontroller
- ▶ Wide operating system and RTOS support - including Windows CE, Palm OS, Symbian OS, Linux and market-leading RTOS
- ▶ Wide choice of development tools
- ▶ Simulation models for leading EDA environments
- ▶ Excellent debug support for SoC designers, including ETM interface
- ▶ Multiple sourcing from industry-leading silicon vendors
- ▶ Availability in 0.25µm, 0.18µm and 0.14µm processes
- ▶ Migration and support across new process technologies
- ▶ Code is forward-compatible to ARM9, ARM9E and ARM11 processors as well as Intel's XScale technology

Based on an ARM7TDMI-S core operating at up to 72 MHz, NXP's LPC2000 and LH7 32-bit microcontrollers deliver high performance and low power consumption in a cost-effective package. In addition to offering integrated LCD support, they offer a wide range of peripherals, including multiple serial interfaces, Ethernet, USB Host/OTG, CAN, and external bus options and are designed for use in general purpose and specialty embedded applications such as industrial control, automotive, medical, and connectivity.

# LPC28xx Devices

The LPC2888 offers 1 MB of Flash, 64 KB of SRAM, external memory interfaces, high-speed (480 Mbps) USB 2.0, a 10-bit A/D converter, and multiple serial interfaces. The LPC2880 is a ROM-less version of the LPC2888. Both operate from a single AA(A) battery cell or a USB input.

## KEY FEATURES

- ▶ 60-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces and 8 KB of cache
- ▶ Up to 1 MB of Flash
- ▶ 64 KB of SRAM
- ▶ External memory controller for SDRAM, Flash, SRAM
- ▶ Very fast Flash programming via on-chip boot loader software
- ▶ USB 2.0 high-speed (480 Mbps) device with PHY and DMA
- ▶ High-efficiency switching and linear regulators for power savings
- ▶ Operation from single AA(A) battery cell or USB input
- ▶ General-purpose DMA controller
- ▶ 10-bit A/D converter
- ▶ Multiple serial interfaces: I<sup>2</sup>C, I<sup>2</sup>S, UART with IrDA, 8-bit LCD
- ▶ Two 32-bit timers
- ▶ Real-time clock and Watchdog timer
- ▶ SD Card interface
- ▶ Package: TFBGA180 (10 x 10 x 0.8 mm)



ARM7-based microcontrollers  
with High-Speed USB 2.0  
and 1 MB Flash

1MB of 128-bit-wide Flash (LPC2888 only)	E-ICE/RT interface and embedded-trace macrocell
64-KB SRAM	Vectored interrupt controller and event router
60-MHz, 32-bit ARM7TDMI-S core with AHB and APB interfaces and 8 KB of cache	
External memory controller supporting Flash, SRAM, ROM, SDRAM, and memory-mapped I/O	
Power management, real-time clock, Watchdog timer, PLL on chip DC/DC converter	
General-purpose DMA controller	USB 2.0 full-speed (12 Mbps) and high-speed (480 Mbps) device with on-chip PHY
Timer 0 (32-bit)	Timer 1 (32-bit)
I <sup>2</sup> S	I <sup>2</sup> C
UART with IrDA support	8-bit LCD interface bus
10-bit A/D converter (five channels)	16-bit analog I/O channels
Up to 85 I/O ports	

LPC2888/2880 block diagram

## DEVELOPMENT TOOLS

### NOHAU LPC288x EVALUATION BOARD

- ▶ Power Source Options:
  - AA size battery
  - USB
  - External 5V DC power supply
- ▶ 20 Way JTAG connector
- ▶ 16M (8M x 16) Bytes of SDRAM
- ▶ 8M (4M x 16) Bytes of FLASH
  - Expandable to 16M (8M x 16) Bytes of FLASH
- ▶ 1 x LCD Module with Epson S1D15605 built in
- ▶ 1 x SD Card connector
- ▶ 1 x USB connector (USB B Receptacle Connector for USB Device)
- ▶ 1 x UART (RS232) physical interface circuits connected to standard PC style DB9 male connector
- ▶ 1 x Headphone jack (3.5mm)
- ▶ (Not installed) Additional Headphone jack (3.5mm)
- ▶ 2 x 10, 2 x 20 pin break-out headers
- ▶ Reset pushbutton switch
- ▶ Mode Selection pushbutton switches
- ▶ Start, Stop pushbutton switches
- ▶ 1 x User output LED
- ▶ 3 x Power Supply Status LEDs
- ▶ Small prototyping area consisting of an area of 0.1 inch spaced through-holes with easy access to ground and 3.3V power supply points



### LPC288x SELECTION GUIDE

Type	Memory		Serial interfaces					ADC channels (10-bit)	Package
	Flash (MB)	SRAM (KB)	USB 2.0 (12 or 480 Mbps)	I <sup>2</sup> S	I <sup>2</sup> C	UART (IrDA)	LCD (8-bit)		
LPC2880 <sup>(1)</sup>	0	64	1	1	1	1	1	5	TFBGA180
LPC2888	1	64	1	1	1	1	1	5	TFBGA180

(1) LPC2880 is ROM-less version of LPC2888

# LH7 Devices

These flexible, powerful microcontrollers, based on ARM7 cores, integrate an LCD controller, so they save time-to-market for applications that use an LCD screen. Supported by comprehensive software and hardware design tools, they make it easy to design a wide range of applications.

## KEY FEATURES

- ▶ Powerful, flexible ARM cores
  - 84-MHz, 32-bit ARM7TDMI-S™ (LH754xx)
  - 77-MHz, 32-bit ARM720T™ (LH7952x)
- ▶ Integrated LCD controller
  - Support for STN, CSTN, TFT, and AD-TFT
  - Resolutions up to 1024 x 768
  - 16-level greyscale or up to 64k colors
- ▶ Integrated touchscreen controller
- ▶ 16- or 32-bit external bus with optional SDRAM controller and NAND Flash boot capability
- ▶ Up to 32 KB of internal SRAM and 8 KB of cache
- ▶ Up to 10-channel, 10-bit A/D converter
- ▶ Multiple 16-bit counter/timers and multiple PWMs
- ▶ Real-time clock, Watchdog timer, and PLL
- ▶ Extensive selection of serial interfaces, including SSI/SSP, multiple UARTs, IrDA, I<sup>2</sup>C-bus, I<sup>2</sup>S, CAN 2.0B, USB 2.0 device, 10/100 Base-T Ethernet MAC
- ▶ 5 V - tolerant I/O
- ▶ Up to 104 GPIO
- ▶ Temperature range: -40 to +85°C
- ▶ LQFP and LFBGA packages



NXP ARM7-based microcontroller with integrated LCD controller LH754xx and LH7952x

16-bit external data bus (LH754xx, LH79525) or 32-bit external data bus (LH79520, LH79524)	NAND Flash boot capability (LH79524, LH79525)
Up to 32 KB of SRAM	SDRAM controller (LH7952x)
84-MHz, 32-bit ARM7TDMI-S core (LH754xx) 77-MHz, 32-bit ARM720T core (LH7952x)	
Watchdog timer, real-time clock, PLL	
Color / greyscale LCD controller (LH75401, LH75411, LH7952x) or Greyscale LCD controller (LH75400, LH75410)	
Integrated touchscreen controller (LH754xx, LH79524, LH79525)	Multi-channel, high-resolution A/D converter (LH754xx, LH79524, LH79525)
10/100 Base-T Ethernet MAC (LH79524, LH79525)	USB 2.0 full-speed device (LH79524, LH79525)
SSI/SSP and multiple UARTS	IrDA (LH7952x)
I <sup>2</sup> C-bus or SMBus (LH79524, LH79525)	CAN 2.0B (LH75400, LH75401)
Multiple 16-bit counter/timers	Multiple PWMs
76 GPIO (LH754xx) 64/86/104 GPIO (LH7952x)	

LH754xx and LH7952x block diagram

## DEVELOPMENT TOOLS

### LOGIC PD NXP ZOOM™ SDK SUPPORTS LH7A/LH7

- ▶ Operating Systems<sup>1</sup>:
  - Windows CE
  - Linux
  - VxWorks
  - Nucleus
  - MQX RTOS
  - Micro Digital SMX RTOS
- ▶ Optional Display Kits
- ▶ Includes NXP Card Engine module:
  - LH7A404 Card Engine
  - LH75401 Card Engine
  - LH79524 Card Engine
- ▶ Standard peripheral connectors supporting: Ethernet, LCD, audio in/out, serial, CompactFlash, USB host<sup>2</sup>, USB device<sup>2</sup>
- ▶ LogicLoader™ (boot loader/monitor) in executable format
- ▶ GNU cross-development tools (compiler, linker, assembler, debugger) included

- ▶ Kit contents:
  - Card Engine
  - Application baseboard
  - Null-modem serial cable
  - Ethernet crossover cable
  - 5 volt power supply with power adapters (Europe, Japan, UK, and US)
  - Logic Starter CD
  - QuickStart Guide
- ▶ Zoom™ SDK baseboard (102 x 152 x 16.8 mm)

1) Refer to Card Engine for availability

2) Refer to specific Card Engine Product Information for peripherals support



## LH7754xx AND LH7952x SELECTION GUIDE

Type	CPU Core	RAM	GPIO	LCD controller	A/D converter	Serial interfaces	Temperature range (°C)	Package
LH75400	ARM7TDMI-S	32 KB	76	1024 x 768 16-level greyscale	8 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART, CAN 2.0B	-40 to +85	LQFP144
LH75401	ARM7TDMI-S	32 KB	76	640 x 480: 4096 colors 800 x 600: 256 colors 1024 x 768: 16 colors	8 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART, CAN 2.0B	-40 to +85	LQFP144
LH75410	ARM7TDMI-S	32 KB	76	1024 x 768 16-level greyscale	8 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART	-40 to +85	LQFP144
LH75411	ARM7TDMI-S	32 KB	76	640 x 480: 4096 colors 800 x 600: 256 colors 1024 x 768: 16 colors	8 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART	-40 to +85	LQFP144
LH79520	ARM720T	8 KB (cache) 32 KB (SRAM)	64	800 x 600: 64k colors 1024 x 768: 256 colors	—	SPI/SSP, 3 x UART, IrDA	-40 to +85	LQFP176
LH79524	ARM720T	8 KB (cache) 16 KB (SRAM)	104	800 x 600: 64k colors 1024 x 768: 256 colors	10 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART, IrDA, I <sup>2</sup> C-bus, I <sup>2</sup> S, USB 2.0 device, 10/100 Base-T Ethernet	-40 to +85	LFPGA208
LH79525	ARM720T	8 KB (cache) 16 KB (SRAM)	86	800 x 600: 64k colors 1024 x 768: 256 colors	10 x 10-bit with touchscreen interface	SPI/SSP, 3 x UART, IrDA, I <sup>2</sup> C-bus, I <sup>2</sup> S, USB 2.0 device, 10/100 Base-T Ethernet	-40 to +85	LQFP176

# LPC24xx Devices

Built for connectivity, these powerful yet cost-effective microcontrollers support 10/100 Ethernet, full-speed (12 Mbps) USB 2.0, USB OTG, and CAN 2.0B. They have 512 KB of ISP/ IAP Flash, 98 KB of SRAM, an external memory interface, 10-bit A/D and D/A converters, an internal RC oscillator, and an SD memory-card interface on two high-speed buses to eliminate communication bandwidth bottlenecks. The LPC247x adds a QVGA LCD controller.

## KEY FEATURES

- ▶ 72-MHz, 32-bit ARM7TDMI-S with dual AHB buses
- ▶ 512 KB of ISP/IAP Flash and 98 KB of SRAM
- ▶ External memory interface for SDRAM, SRAM, and Flash
- ▶ 10/100 Ethernet MAC with DMA and MII/RMII interface
- ▶ USB 2.0 full-speed OTG/Device/OHCI plus PHY and DMA
- ▶ Two CAN 2.0B controllers with acceptance filtering
- ▶ General-purpose DMA controller
- ▶ 10-bit A/D converter and 10-bit D/A converter
- ▶ XGA LCD controller with dedicated DMA for TFT and STN panels (LPC247x only)
- ▶ Multiple serial interfaces: three I<sup>2</sup>C, one I<sup>2</sup>S, four UARTs, three SPI/SSP
- ▶ Two PWM units
- ▶ Four 32-bit timers, a low-power real-time clock, and a Watchdog timer
- ▶ 4-MHz internal RC (IRC) oscillator trimmed to 1% accuracy
- ▶ 160 general-purpose Fast I/O pins
- ▶ Single 3.3-V power supply
- ▶ Boundary scan
- ▶ Packages:
  - LGFP208 (28 x 28 x 1.4 mm)
  - TFBGA208 (15 x 15 x .08 mm)
  - TFBGA180 (12 x 12 x 0.8 mm)



ARM7 MCU with Ethernet, USB OTG, CAN, and optional LCD controller

Up to 512 KB of 128-bit-wide ISP/IAP Flash	E-ICE/RT interface and embedded-trace macrocell
98 KB of total SRAM	Enhanced vectored interrupt controller
72-MHz, 32-bit ARM7TDMI-S core with dual AHB buses	
Power management, 3.3-V supply, real-time clock, Watchdog timer, internal RC, PLL	
10/100 Ethernet MAC with 16 KB of SRAM	Two CAN buses with acceptance filters
USB 2.0 full-speed device, OHCI/OTG with PHY, DMA, and 4 KB FIFO	General-purpose DMA controller
10-bit A/D converter (eight channels)	10-bit D/A converter (one channel)
Four 32-bit timers (with capture/compare channels)	PWM unit
Four UARTs (UART1 with modem control)	SD/MMC memory-card interface
I <sup>2</sup> S	Three I <sup>2</sup> C
One SPI and two SSP	Real-time clock with 2-KB battery-backed RAM
LCD controller for XGA STN and TFT displays (LPC247x only)	
160 Fast I/O pins	

LPC24xx block diagram



## DEVELOPMENT TOOLS

### HITEX LPC-STICK - LPC2468

Discover the performance of the LPC2468 ARM7TDMI core with the LPC-Stick. The LPC-Stick is a small modular evaluation kit with optional extension boards. The LPC-Stick package provides target hardware with the LPC2468 microcontroller from NXP, external SRAM, user pins and LEDs for applications use. Combined with the proven USB debugger device connection and the non-limited HiTOP development tools, the LPC-Stick allows full access to all chip features, debugging and programming.

- ▶ LPC-Stick hardware with LPC2468 microcontroller (ARM7TDMI-S CPU core), Ethernet, USB/OTG, CAN, Extension connector, User LEDs, user I/O, etc.
- ▶ Extension connector for Samtec micro edge connector MEC6-140-02-L-D-RA1
- ▶ Power regulator from National Semiconductor
- ▶ Stick demo application with GUI control software
- ▶ HiTOP5 IDE and debugger
- ▶ GNU C/C++ compiler
- ▶ Tasking VX-Toolset (limited evaluation version)
- ▶ USB interface for debugging, programming and virtual COM port for user application
- ▶ CD containing toolchain and useful information and datasheets



### EMBEDDED ARTISTS LPC2468 OEM BOARD

- ▶ LPC2468 in BGA, Small form factor board (70 x 66 mm)
- ▶ 100/10Mbps Ethernet PHY
- ▶ 256 Mbit SDRAM, 1 Gbit NAND FLASH, 32 Mbit NOR FLASH, 256 Kbit EEPROM
- ▶ Ethernet connector, USB OTG/Host/Device connectors, MMC/SD connector, CAN interface and connector, JTAG and ETM connectors
- ▶ USB-to-serial bridge (UART #0), Full modem RS232 on UART #1
- ▶ Keys/LEDs via I<sup>2</sup>C
- ▶ Power supply
- ▶ 192 pin expansion connector (2 mm pitch)
- ▶ QVGA expansion
- ▶ WLAN expansion



### LPC2468 INDUSTRIAL REFERENCE DESIGN

- ▶ Core PCB
  - LPC2468-B MCU
  - Flash Memory
  - SRAM
  - Ethernet PHY
- ▶ Base PCB
  - USB HOST & Device Ports
  - 2 CAN Ports
  - 2 RS232 Ports
  - Ethernet Port
  - I<sup>2</sup>C – RS485
  - Power Over Ethernet
  - Temp Sensor
  - Piezo
  - VFD/LCD Interface
- ▶ Software
  - Micrium OSII RTOS
  - CAN
  - Ethernet (Micrium)
  - RS232
  - USB HOST & Device (Micrium)



## LPC24xx SELECTION GUIDE

Type	Memory			Serial interfaces								LCD controller	ADC/DAC options		Package
	Flash (KB)	SRAM (KB)	External interface	10/100 Ethernet	USB 2.0 (OTG/OHCI/DEV)	CAN	UART	I <sup>2</sup> C	I <sup>2</sup> S	SPI/SSP	SD/MMC		ADC channels (10-bit)	DAC channels (10-bit)	
LPC2458FET180	512	98	16-bit	1 (MII/RMII)	1	2	4	3	1	3	1	–	8	1	TFBGA180
LPC2460FBD208	–	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	–	8	1	LQFP208
LPC2460FET208	–	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	–	8	1	TFBGA180
LPC2468FBD208	512	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	–	8	1	LQFP208
LPC2468FET208	512	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	–	8	1	TFBGA180
LPC2470FBD208	–	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	1	8	1	LQFP208
LPC2470FET208	–	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	1	8	1	TFBGA180
LPC2478FBD208	512	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	1	8	1	LQFP208
LPC2478FET208	512	98	Full 32-bit	1 (MII/RMII)	1	2	4	3	1	3	1	1	8	1	TFBGA180

# LPC23xx Devices

Built for connectivity, these powerful yet cost-effective microcontrollers support 10/100 Ethernet, full-speed (12 Mbps) USB 2.0, and CAN 2.0B. They have up to 512 KB of ISP/IAP Flash, up to 98 KB of SRAM, 10-bit A/D and D/A converters, an IRC oscillator, and options for an SD memory-card interface.

## KEY FEATURES

- ▶ 72-MHz, 32-bit ARM7TDMI-S with dual AHB buses
- ▶ Up to 512 KB of ISP/IAP Flash
- ▶ Up to 98 KB of SRAM
- ▶ Very fast Flash programming via on-chip boot loader
- ▶ 10/100 Ethernet MAC interface with DMA
- ▶ USB 2.0 full-speed (12 Mbps) device with PHY and DMA
- ▶ USB 2.0 full-speed Open Host Control Interface / On-The-Go (LPC2388 only)
- ▶ Two CAN 2.0B controllers with acceptance filtering
- ▶ General-purpose DMA controller 4 10-bit A/D converter and 10-bit D/A converter
- ▶ Multiple serial interfaces: three I<sup>2</sup>C, one I<sup>2</sup>S, four UARTs, and three SPI/SSPs
- ▶ Four 32-bit timers
- ▶ Real-time clock and Watchdog timer
- ▶ 4-MHz internal RC (IRC) oscillator trimmed to 1% accuracy
- ▶ Secure Digital (SD) memory-card interface (LPC2368/77/78/87/88 only)
- ▶ Single 3.3-V power supply (3.0 to 3.6 V)
- ▶ Several power-down modes, including "deep-power-down"
- ▶ Boundary scan (LPC2377/78/88 only)
- ▶ Packages:
  - LQFP100 (14 x 14 x 1.4 mm)
  - LQFP144 (20 x 20 x 1.4 mm)
  - TFBGA100 (9 x 9 x 0.7 mm)



ARM7-based microcontrollers with Ethernet, USB, and CAN peripherals

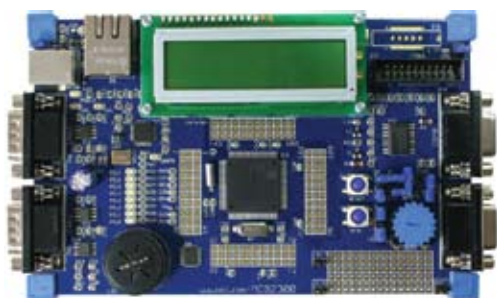
Up to 512 KB of 128-bit-wide ISP/IAP Flash	E-ICE/RT interface and embedded-trace macrocell
Up to 98 KB of total SRAM	Enhanced vectored interrupt controller
72-MHz, 32-bit ARM7TDMI-S core with dual AHB buses	
Power management, 3.3-V supply, real-time clock, Watchdog timer, internal RC, PLL	
10/100 Ethernet MAC with 16 KB of SRAM	Two CAN buses with acceptance filters
USB 2.0 full-speed device, OHCI/OTG with PHY, DMA, and 4 KB FIFO	General-purpose DMA controller
10-bit A/D converter (up to eight channels)	10-bit D/A converter (one channel)
Four 32-bit timers (with capture/compare channels)	PWM unit
Four UARTs (UART1 with modem control)	SD/MMC memory-card interface (LPC2368 and LPC2378 only)
I <sup>2</sup> S	Three I <sup>2</sup> C
One SPI and two SSP	Real-time clock with 2-KB battery-backed RAM
70 I/O pins 104 I/O pins (LPC2377/78/88)	

LPC23xx block diagram

## DEVELOPMENT TOOLS

### MCB2300 EVALUATION BOARDS FROM KEIL

- ▶ Connects to your PC using:
  - Serial port for Flash download using FlashMagic
  - JTAG interface for program debug using the Keil ULINK and µVision IDE and Debugger
- ▶ Two board options:
  - MCB236x with 100 pin LPC2368
  - MCB237x with 144 pin LPC2378
- ▶ Board features:
  - On-chip Ethernet interface
  - USB device interface
  - Two serial interfaces
  - Two CAN interfaces
  - Speaker
  - Analog input (via potentiometer)
  - Eight LEDs



### IAR KICKSTART KIT FOR LPC2378

- ▶ Color LCD
- ▶ 2xRS232 serial port
- ▶ 2xCAN drivers and connectors
- ▶ SD/MMC card connector
- ▶ 2 user buttons, Reset button
- ▶ 1 joystick
- ▶ JTAG connector
- ▶ Trace mictor connector
- ▶ USB connector
- ▶ Headphone & MIC connector
- ▶ Available directly from IAR



## LPC23xx SELECTION GUIDE

Type	Memory		Serial interfaces										ADC/DAC options		Package
	Flash (KB)	SRAM (KB)	10/100 Ethernet	USB 2.0 (12 Mbps)	CAN	UART	I <sup>2</sup> C	I <sup>2</sup> S	SPI	SSP	SD/ MDC	ADC channels (10-bit)	DAC channels (10-bit)		
LPC2364Fxx100	128	34	1 (RMII)	Device	2	4	3	1	1	2	–	6	1	LQFP100, TFBGA100	
LPC2365FBD100	256	58	1 (RMII)	–	–	4	3	1	1	2	•	6	1	LQFP100	
LPC2366FBD100	256	58	1 (RMII)	Device	2	4	3	1	1	2	–	6	1	LQFP100	
LPC2367FBD100	512	58	1 (RMII)	–	–	4	3	1	1	2	•	6	1	LQFP100	
LPC2368Fxx100	512	58	1 (RMII)	Device	2	4	3	1	1	2	•	6	1	LQFP100, TFBGA100	
LPC2377FBD144 <sup>(1)</sup>	512	58	1 (RMII)	–	–	4	3	1	1	2	•	8	1	LQFP144	
LPC2378FBD144 <sup>(1)</sup>	512	58	1 (RMII)	Device	2	4	3	1	1	2	•	8	1	LQFP144	
LPC2387FBD100	512	98	1 (RMII)	Device	2	4	3	1	1	2	•	6	1	LQFP100	
LPC2388FBD144 <sup>(1)</sup>	512	98	1 (RMII)	OHCI/OTG/ Device	2	4	3	1	1	2	•	8	1	LQFP144	

(1) LPC2377, LPC2378, and LPC2388 are equipped with MiniBus

# LPC22xx Devices

This family of high-performance microcontrollers includes parts that integrate up to 256 KB of on-chip Flash, 16 KB of on-chip RAM, a 10-bit ADC, and an external memory interface. There are options for up to four CAN interfaces and can provide support for extended temperature ranges. The Flashless LPC22x0 delivers performance up to 75MHz with up to 64 KB of on-chip RAM.

## KEY FEATURES

- ▶ 60-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces
  - \* Up to 75MHz for the LPC22x0
- ▶ Up to 256 KB of ISP/IAP Flash
  - \* Up to 64 KB of SRAM for the LPC22x0
- ▶ 16 KB of SRAM
- ▶ 8-channel, 10-bit A/D converter
- ▶ Two CAN buses for the LPC2290 only
- ▶ Up to four CAN buses for the LPC229x
- ▶ External memory interface
- ▶ Optional 16-bit Thumb Mode for code-size critical applications
- ▶ Very fast Flash programming via on-chip boot loading software
- ▶ Two 32-bit timers and one PWM unit
- ▶ Real-time clock and Watchdog timer
- ▶ Multiple serial interfaces: two UARTs, Fast I<sup>2</sup>C-bus, two SPI
- ▶ 112 I/O pins
  - \* 76 I/O pins for the LPC22x0
- ▶ Temperature range: -40 to + 85 °C
  - \* Optional extended temperature range: -40 to + 125 °C (LPC2294 only)
- ▶ Small LQFP144 and TFBGA144 packages
  - \* TFBGA144 for LPC2220 & 2292 only



NXP 60 and 75-MHz, 32-bit ARM7TDMI-S™ processors LPC22xx

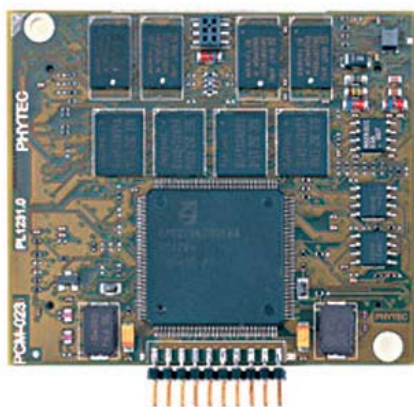
Up to 256 KB of ISP/IAP, 128-byte-wide Flash *No Flash for LPC22x0	E-ICE/ETM interface and embedded-trace macrocell
Up to 64 KB of SRAM	Vectored Interrupt Controller
Up to 75-MHz, 32-bit ARM7TDMI-S core with AHB/APB buses	
Power management, real-time clock, Watchdog timer, PLL	
8-channel, 10-bit A/D converter	Up to four CAN buses LPC2290 has 2 CAN buses LPC2294 has 4 CAN buses
Two 32-bit timers (with capture/compare channels)	PWM
Two UARTs (UART 1 with modem control)	
Two SPI interfaces	I <sup>2</sup> C-bus
Up to 112 I/O pins	

LPC22xx block diagram

## DEVELOPMENT TOOLS

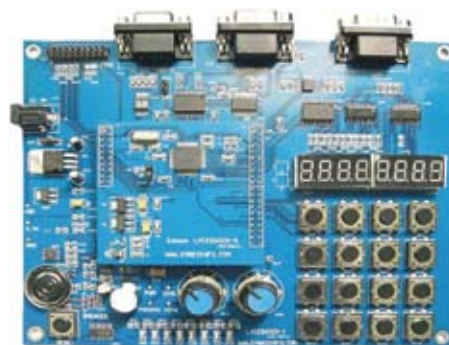
### PHYTEC PHYCORE-ARM7/LPC229x USE TO DEVELOP WITH ALL LPC22XX PARTS

- ▶ Single Board Computer (53mm x 62mm)
- ▶ Two 100-pin Molex connectors
- ▶ Memory:
  - SRAM : 1MB to 8MB asynchronous
  - FLASH : 1MB to 16MB asynchronous
  - EEPROM : 1KB to 8KB
- ▶ 10/100Mbit SMSC LAN91C111 Ethernet Controller
- ▶ I<sup>2</sup>C Real-Time clock with calendar & alarm function
- ▶ Two UART interfaces with RS232 transceivers
- ▶ Up to 4 CAN interfaces, support of CAN signal transceivers for max. 2 interfaces on board



### EMBEST LPCEB2000 EVALUATION BOARD USE TO EVALUATE LPC211x/2x/3x/94 AND ALL LPC22xx

- ▶ Kit consists of Module Board + Expansion Board + Embest IDE
- ▶ Expansion Board:
  - Dimensions: 182 x 139 mm
  - 2 serial ports, 1 CAN port, I<sup>2</sup>C bus
  - 1 reset button, 4x4 keyboard
  - 8 indicator lights, 8-digit 8-segment LED
  - 2-channel AD sampling input
  - 2-channel PWM output (to buzzer and to PWMDAC), Analog output to speaker
  - 20-pin standard JTAG port
- ▶ Module Board (plugs into Expansion board)
  - LPCEB2000-S (for LPC211x/2x/9x)
  - LPCEB2000-A (for LPC213x)
  - LPCEB2000-B (for LPC22xx)



## LPC22xx SELECTION GUIDE

Type	Memory		I/O pins	10-bit A/D converter channels	External Memory Interface	CAN bus	Serial interfaces			Temperature range (°C)	Package
	Flash (KB)	SRAM (KB)					I <sup>2</sup> C	UART	SPI		
LPC2210	0	16	76	8	•	–	1	2	2	-40 to +85	LQFP144
LPC2212	128	16	112	8	•	–	1	2	2	-40 to +85	LQFP144
LPC2214	256	16	112	8	•	–	1	2	2	-40 to +85	LQFP144
LPC2220	–	64	76	8	•	0	1	2	2	-40 to +85	LQFP144 TFBGA144
LPC2290	–	16	76	8	•	2	1	2	2	-40 to +85	LQFP144
LPC2210	–	16	76	8	•	0	1	2	2	-40 to +85	LQFP144
LPC2290	0	16	76	8	•	2	1	2	2	-40 to +85	LQFP144
LPC2292	256	16	112	8	•	2	1	2	2	-40 to +85	LQFP144 TFBGA144
LPC2292	256	16	112	8	•	4	1	2	2	-40 to +125	LQFP144

# LPC215x, LPC214x and LPC213x Devices

These powerful yet cost-effective microcontrollers offer USB 2.0 full-speed (12Mbps) capability. Most have up to two 10-bit A/D converters and a 10-bit D/A converter. In addition to having multiple interfaces (CAN, I<sup>2</sup>Cs, UARTs, SPIs and SSP), these high-performance MCUs have up to 512 KB of ISP/IAP Flash and can support an extended temperature range.

The LPC2157/58 is a combination of a high-performance ARM7-based microcontroller with a flexible LCD driver, making it easy to integrate advanced technology into everyday applications.

## KEY FEATURES

- ▶ 60-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces
- ▶ Up to 512 KB of ISP/IAP Flash
- ▶ Up to 40 KB of SRAM
- ▶ Very fast Flash programming via on-chip boot loader
- ▶ USB 2.0 full-speed (12 Mbps) device (LPC2158)
- ▶ 32 segments x 4 backplanes LCD controller
- ▶ Up to two 10-bit A/D converters
  - \* Enhanced features on LPC213x/01 versions
- ▶ 10-bit D/A converter
- ▶ Multiple serial interfaces: up to two I<sup>2</sup>Cs, two UARTs, one SPI, and one SSP
- ▶ Two 32-bit timers
- ▶ Real-time clock and Watchdog timer
- ▶ Up to 47 I/O pins (5-V tolerant)
- ▶ Single 3.3-V supply
- ▶ Temperature Range: -40 to +85°C
- ▶ LQFP64 package (10 x 10 x 1.4 mm)
- ▶ HVQFN64 package (9 x 9 x 0.85 mm)
- ▶ LQFP100 package (14 x 14 x 1.4 mm)



ARM7-based microcontrollers with LCD driver, USB 2.0, 10-bit ADC, 10-bit DACs and CAN

Up to 512 KB of 128-bit-wide ISP/IAP Flash	E-ICE/RTM interface and embedded-trace macrocell
Up to 32 KB of SRAM	Vectored Interrupt Controller
60-MHz, 32-bit ARM7TDMI-S™ core with AHB and APB interfaces	
Power management, 3.3-V supply, real-time clock, Watchdog timer, PLL	
32 segments x 4 backplanes LCD controller (LPC2157 & LPC2158 only)	10-bit D/A converter (one channel)
Up to two 10-bit A/D converters (8 channels each)	PWM unit (six outputs)
Two 32-bit timers (four capture/compare channels each)	Two I <sup>2</sup> C
up to two UARTs	SPI, SSP
USB 2.0 FS Device (LPC214x and LPC2158)	
up to 47 I/O ports	

LPC213x, 214x and 215x block diagram



## DEVELOPMENT TOOLS

### KEIL MCB2130/MCB2140 EVALUATION BOARDS USE TO EVALUATE LPC2141/42/44/46/48

- ▶ 2x 9-pin D-type Serial for serial communications ports
- ▶ 8 status LEDs
- ▶ Speaker on DAC output
- ▶ Potentiometer for ADC demos
- ▶ SD Card Interface
- ▶ Software support for USB



### IAR KS2148 EVALUATION BOARD USE TO EVALUATE LPC2141/42/44/46/48

- ▶ 2x 9-pin D-type Serial for serial communications ports
- ▶ 8 status LEDs
- ▶ Speaker on DAC output
- ▶ Potentiometer for ADC demos
- ▶ SD Card Interface
- ▶ Software support for USB



## LPC213x, LPC214x, LPC215x SELECTION GUIDE

Type	Memory		I/O Pins	CAN BUS	Serial interfaces					ADC/DAC options		Temperature range (°C)	Enhanced UARTs, ADC, Fast I/Os and BOD	Package
	Flash (KB)	SRAM (KB)			USB 2.0 (12Mbps)	USB DMA	I <sup>2</sup> C	UART	SPI/SSP	ADC channels (10-bit)	DAC channels (10-bit)			
LPC2131/01	32	8	7	–	–	–	2	2	1	8	1	-40 to +85	•	LQFP64
LPC2132/01	64	16	7	–	–	–	2	2	1	8	1	-40 to +85	•	LQFP64, HVQFN64
LPC2134/01	128	16	7	–	–	–	2	2	1	16	1	-40 to +85	•	LQFP64
LPC2136/01	256	32	7	–	–	–	2	2	1	16	1	-40 to +85	•	LQFP64
LPC2138/01	512	32	7	–	–	–	2	2	1	16	1	-40 to +85	•	LQFP64, HVQFN64
LPC2141	32	8	45	–	1	–	2	2	2	6	–	-40 to +85	–	LQFP64
LPC2142	64	16	45	–	1	–	2	2	2	6	1	-40 to +85	–	LQFP64
LPC2144	128	16	45	–	1	–	2	2	2	14	1	-40 to +85	–	LQFP64
LPC2146	256	40	45	–	1	1	2	2	2	14	1	-40 to +85	–	LQFP64
LPC2148	512	40	45	–	1	1	2	2	2	14	1	-40 to +85	–	LQFP64
LPC2157	512	32	36	–	–	–	1	2	2	12	1	-40 to +85	–	LQFP100
LPC2158	512	40	36	–	1	1	1	2	2	10	1	-40 to +85	–	LQFP100

# LPC21xx Devices

These powerful yet cost-effective microcontrollers are equipped with up to 256 KB of on-chip Flash, up to 16 KB of SRAM, and optional CAN 2.0B bus interfaces. They are also equipped with a 10-bit A/D converter, multiple serial interfaces and are available in small 10 x 10 x 1.4 mm.

## KEY FEATURES

- ▶ 60-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces
- ▶ Up to 256 KB of ISP/IAP Flash
- ▶ Up to 16 KB of SRAM
- ▶ 4-Channel, 10-bit ADC
- ▶ External Memory Interface
- ▶ Up to four CAN interfaces
- ▶ Optional 16-bit Thumb Mode for code-size critical applications
- ▶ Very fast Flash programming via on-chip boot loading software
- ▶ Two 32-bit timers and one PWM unit
- ▶ Real-time clock and Watchdog timer
- ▶ Multiple serial interfaces: two UARTs, Fast I<sup>2</sup>C-bus, two SPI
- ▶ 46 I/O pins
- ▶ Temperature range: -40 to +85°C
  - \* Extended option of -40 to +125°C for LPC2194 only
- ▶ Tiny LQFP64 package



ARM7-based MCUs with  
128-KB Flash and 10-bit ADC

Up to 256 KB of ISP/IAP 128-bit-wide Flash	E-ICE/RT interface and embedded-trace macrocell
16 KB of SRAM	Vectored Interrupt Controller
60-MHz, 32-bit ARM7TDMI-S™ core with AHB/APB buses	
Power management, real-time clock, Watchdog timer, PLL	
4-channel, 10-bit A/D converter	Up to four CAN buses
Two 32-bit timers (with capture/ compare channels)	PWM
Two UARTs (UART 1 with modem control)	
Two SPI interfaces	I <sup>2</sup> C-bus
46 I/O ports	

LPC21xx block diagram



## DEVELOPMENT TOOLS

### KEIL MCB2100 EVALUATION BOARD

USE TO EVALUATE LPC2109/14/19/24/29/94

- ▶ Powered from USB or 7-12V DC input
- ▶ TTL compatible, 2.4V threshold
- ▶ 2" x .75" prototype area
- ▶ Compatible with Hammond 1455C801 enclosure
- ▶ Accepts 3.5mm terminal, DB or 0.1" connectors
- ▶ USB A-B cable
- ▶ Simply Connected™ software on CD



### EMBEDDED ARTISTS CAN QUICKSTART BOARD

- ▶ Processor: NXP's ARM7TDMI LPC2129 microcontroller
- ▶ Program Flash: 256 KB
- ▶ Data Memory: 16 KB
- ▶ CAN: Dual CAN channels with TJA1040 or TJA1041 transceivers
- ▶ Clock Crystals: 12.0000 MHz crystal for maximum execution speed and standard CAN bit rates (5 x PLL = 60 Mhz CPU clock)
- ▶ Dimensions: 55 x 58 mm
- ▶ Power: On-board low-dropout voltage and reset generation
  - Generates +3.3V and +1.8V from a +5V supply
  - +3.3V available for external circuits, up to 300 mA
  - Power supply: 5 VDC
- ▶ Connectors
  - Dual 2x16 pins I/O connectors
  - All LPC2129 I/O pins are available on connectors
  - RS232, DSUB-9 (ESD/EMI protected)
- ▶ Other
  - 256 Kbit I2C E2PROM
  - Simple and automatic program download (ISP) via serial channel. Circuit that automatically controls the boot loader from RS232 channel
  - Four layer PCB (FR-4 material) for best noise immunity
  - Easy to connect to JTAG signals



## LPC21xx SELECTION GUIDE

Type	Memory		I/O Pins	10-bit ADC Channels	CAN bus	Serial Interfaces			Temperature range (°C)	Package
	Flash (KB)	SRAM (KB)				I²C Bus	UART	SPI		
LPC2109/01	64	8	46	4	–	1	2	2	-40 to +85	LQFP64
LPC2114/01	128	16	46	4	–	1	2	2	-40 to +85	LQFP64
LPC2119/01	128	16	46	4	2	1	2	2	-40 to +85	LQFP64
LPC2124/01	256	16	46	4	–	1	2	2	-40 to +85	LQFP64
LPC2129/01	256	16	46	4	2	1	2	2	-40 to +85	LQFP64
LPC2194/01	256	16	46	4	4	1	2	2	-40 to +125	LQFP64

## LPC2104/05/06 Devices

These powerful yet cost-effective microcontrollers have 128 KB of zero wait-state, security-enabled Flash and up to 64 KB of SRAM. Each has multiple serial interfaces and is available in a package that measures only 7 x 7 mm.

### KEY FEATURES

- ▶ 60-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces
- ▶ Code Read Protection mechanism to safeguard user code
- ▶ 128 KB of zero wait-state, security-enabled Flash
- ▶ Up to 64 KB of SRAM
- ▶ Very fast Flash programming via on-chip boot loader
- ▶ Multiple serial interfaces: I<sup>2</sup>C, two UART, SPI/SSP
- ▶ Two 32-bit timers
- ▶ Six-channel PWM unit
- ▶ Real-time clock with 32-kHz crystal and battery back-up pins
- ▶ Watchdog timer
- ▶ 32 fast GPIO
- ▶ LQFP48 and HVQFN48 package options



NXP 60-MHz, 32-bit microcontrollers with ARM7TDMI-S™ core  
LPC2104/5/6

128 KB ISP/IAP security-enabled Flash	E-ICE/RT interface
Up to 64 KB SRAM	Vectored interrupt controller
60-MHz, 32-bit ARM7TDMI-S core with AHB and APB interfaces	
Power management, real-time clock, Watchdog timer, PLL	
Two 32-bit timers with four capture/compare channels	
UART 0-1 (UART 1 with modem control)	I <sup>2</sup> C
PWM	SPI, SSP
32 fast GPIO	

LPC2104/05/06 block diagram

# DEVELOPMENT TOOLS

## IAR KS2106 EVALUATION BOARD USE TO EVALUATE LPC2104/5/6

- ▶ 2x 9-pin D-type Serial communications ports
- ▶ LEDs can be connected to selected port-pins
- ▶ 3 switches for interrupts
- ▶ Plated-through-hole prototyping matrix
- ▶ Breakout ports for Logic Analyzer connection



## NOHAU LPC210X EVALUATION BOARD USE TO EVALUATE LPC2104/5/6

- ▶ Prototyping area
- ▶ Eight LEDs
- ▶ Three pushbuttons
- ▶ Two RS232 connectors
- ▶ Mictor connector (for Trace)
- ▶ Board support packages including  $\mu$ C/OS-II RTOS (with source if book is purchased)



# LPC2104/05/06 SELECTION GUIDE

Type	Memory		Serial interfaces				Package
	Flash (KB)	SRAM (KB)	I <sup>2</sup> C	UART	SPI	SSP	
LPC2104FBD64/01	128	16	1	2	1	1	LQFP48
LPC2105FBD64/01	128	32	1	2	1	1	LQFP48
LPC2106FBD64/01	128	64	1	2	1	1	LQFP48
LPC2106FHN64/01	128	64	1	2	1	1	HVQFN48

## LPC2101/02/03 Devices

These powerful yet cost-effective microcontrollers have up to 32 KB of zero wait-state Flash and up to 8 KB of SRAM. Each has a 10-bit A/D converter with eight channels and multiple serial interfaces, and is available in a package that measures only 7 x 7 mm.

### KEY FEATURES

- ▶ 70-MHz, 32-bit ARM7TDMI-S with AHB/APB interfaces
- ▶ Code Read Protection mechanism to safeguard user code
- ▶ Up to 32 KB of zero wait-state Flash
- ▶ Up to 8 KB of SRAM
- ▶ Very fast Flash programming via on-chip boot loader
- ▶ 10-bit A/D converter with individual result registers
- ▶ Multiple serial interfaces: two I<sup>2</sup>C, two UART, SPI/SSP
- ▶ Four timers: two 32-bit timers, two 16-bit timers
- ▶ Real-time clock with 32-kHz crystal and battery back-up pins
- ▶ Watchdog timer
- ▶ 32 high-speed I/O ports
- ▶ LQFP48 package (7 x 7 x 1.4 mm)



70-MHz, 32-bit microcontroller with ARM7TDMI-S™ core LPC210x

Up to 32 KB ISP/IAP Flash	E-ICE/RT interface
Up to 8 KB SRAM	Vectored interrupt controller
70-MHz, 32-bit ARM7TDMI-S core with AHB and APB interfaces	
Power management, real-time clock, Watchdog timer, PLL	
Two 32-bit timers, two 16-bit timers (with capture and compare)	
UART 0-1 (UART 1 with modem control)	Two I <sup>2</sup> C
10-bit ADC (eight channels)	SPI, SSP
32 high-speed I/O Ports	

LPC210x block diagram

# DEVELOPMENT TOOLS

## KEIL MCB2103 EVALUATION BOARD USE TO EVALUATE LPC2101/2/3

- ▶ 4x 9-pin D-type Serial for serial comm ports and CAN
- ▶ 12 MHz crystal and 32.768 KHz RTC
- ▶ 8 status LEDs
- ▶ 55mm x 18 mm prototyping area
- ▶ Switches for interrupt and Reset
- ▶ Potentiometer for ADC demos



## IAR KS2103 EVALUATION BOARD USE TO EVALUATE LPC2101/2/3

- ▶ Two serial ports
- ▶ Reset button, ISP button, 3 user-defined buttons
- ▶ 16 fully configurable LEDs
- ▶ 16 character x 2 row LCD screen
- ▶ Lithium back-up battery holder
- ▶ 20-pin JTAG interface connector
- ▶ 20x20 array of plated holes for prototyping
- ▶ Schematics included



## LPC210x SELECTION GUIDE

Type	Memory		Serial interfaces				ADC channels (10-bit)	Package
	Flash (KB)	SRAM (KB)	I <sup>2</sup> C	UART	SPI	SPI/SSP		
LPC2101	8	2	2	2	1	1	8	LQFP48
LPC2102	16	4	2	2	1	1	8	LQFP48
LPC2103	32	8	2	2	1	1	8	LQFP48

# ADDITIONAL DEVELOPMENT HARDWARE

## Additional Evaluation/Development Tools

### LPC2000 or LPC3000

Embedded Artists	QuickStart Prototype Board
FDI	USB Programming Dongle Motherboard
FDI	USB ISP Programmer
Hitex	Board Support Packages
iSystem	iF-DEV Self Building Kit (SBK) & Ready Tool Kit (RTK)
Olimex	LPC-H2000 Header Boards
Olimex	LPC-E2124/29/2214/94 Ethernet Boards
ZX Technologies	ZX Workbench zxLPC21xx Development Platform
ZX Technologies	zxCSP Chip Support Packages

### LPC21xx

Embedded Artists	LPC2129 QuickStart Board
Olimex	LPC-P2100 Prototype Boards

### LPC2101/2/3 or LPC2104/5/6

ADM Designs	PLUG2106A Header Board
Aeolus	Development ARMStick 102 Dev Board
Coridium	ARMmite Single Board Computer
Crossware	SE-ARM-P Evaluation Board
Embedded Artists	LPC2106 QuickStart Board
Embedded Artists	LPC2104 Color LCD Game with Bluetooth
ImageCraft	iA2103 Development Board

### LPC213x

Adya Systems/WhizNets	WLAN Development Kit
Embedded Artists	LPC213x/214x QuickStart Board
Embedded Artists	LPC213x 10M/100M Ethernet Quickstart Board
Embedded Artists	WLAN Module
IAR	KS2138 Evaluation Board
Signum	EVB-LPC2138 Evaluation Board

### LPC2468

Embedded Artists	µClinux
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## Emulators/Hardware Debuggers

### Ashling

- ASK-2000 (with EVBA7 Eval Board)
- Opella entry level JTAG emulator
- GENIA networked JTAG emulator
- VITRA networked emulator with Trace

### Hitex

- Tanto ARM & Tanto PT ARM
- Tantino

### Green Hills Software

- Probe
- Slingshots

### SIGNUM

- JTAGjet & JTAGjet-Trace Emulator

### IAR J-Link-KS JTAG Debugger

### Nohau Emul-ARM-Std JTAG Debugger

### Keil U-Link JTAG Debugger

### ARM RealView ICE

### ARM RealView TRACE

### Lauterbach TRACE32

### Embest UNetICE USB & Ethernet JTAG

### Segger J-Link JTAG Debugger

### Amontec JTAGkey Debugger

# OPMENT SUPPORT

## SOFTWARE

### Debuggers, Simulators

Pathfinder debugger	Ashling
ARM RealView debugger	ARM
MULTI debugger	Green Hills
C-SPY debugger ARM	IAR Systems
Keil debugger & simulator µVision3	KEIL
Universal Debug Engine (UDE)	PLS
Chameleon debugger	SIGNUM Systems
NoICE debugger	NoICE
Hitop5 IDE	Hitex
ARM RealView Developer Suite	
Ashling AsIDE	
CrossWare CW ARM Suite	
Green Hills Software MULTI 2000	
IAR EWARM	
ImageCraft ICCV7 for ARM	
Keil µVision3 IDE	
Rowley CrossWorks for ARM	

### Compilers

ARM Compiler	ARM
GNU GCC	Ashling, Microcross, Rowley
GHS Compiler	Green Hills
IAR Compiler	IAR Systems

### RTOS Support

RTOS	Ported to
Nucleus	Nucleus Tools, Keil board
CMX	ARM, Keil
Keil ARTX	Keil
µCOS-II	IAR, Nohau, Keil (app notes available online)
FreeRTOS	Keil
eCos	Ashling
NicheTask	–
ThreadX	IAR, ARM
Pumpkin Salvo	Keil
µClinux	ADS
embOS	Segger
SMX RTOS	uDigital
WinCE	Microsoft

### Application Notes

AN10605 Running eCos on LPC2214
AN10661 Brushless DC motor control using the LPC2141
AN10674 NXP LPC2000 CAN driver with FullCAN mode
AN10687 IEC 60601-1-8 audible alert generator using the LPC2000
AN10689 Full-duplex software UART for LPC2000
AN10675 Interfacing 4-wire and 5-wire resistive touchscreens to the LPC2300
AN10695 Using the LPC288x in audio application

## NOTE

There are a large amount of 3<sup>rd</sup> party tool vendors who produce hardware and software supporting ARM7 and ARM9 products in general and LPC2000/LPC3000 products specifically. This presentation is meant to be a general reference guide for LPC2000/LPC3000 tools and is not all-inclusive. NXP and Future Electronics are not endorsing one 3<sup>rd</sup> party tool over another; nor is the omission of a tool meant to be a negative endorsement. Descriptions and web-links are as accurate as possible, but customers should contact the tool vendors for the most updated information. Support for all tools comes from the tool vendor and not from NXP Semiconductors or Future Electronics. If you discover an error, please contact NXP Microcontrollers Marketing.



[www.adeneo-embedded.com](http://www.adeneo-embedded.com)



[www.adm-designs.com](http://www.adm-designs.com)



[www.aeolusdevelopment.com](http://www.aeolusdevelopment.com)



[www.arm.com](http://www.arm.com)



[www.ashling.com](http://www.ashling.com)



[www.coridiumcorp.com](http://www.coridiumcorp.com)



[www.crossware.com](http://www.crossware.com)



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[www.teamfdi.com](http://www.teamfdi.com)



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[www.hitex.com](http://www.hitex.com)



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